What is claimed is:

1. An illumination subsystem for use in optical analysis of a sample comprising:

a light source generating radiation and means for spatially and angularly homogenizing at least a portion of said radiation, said means for spatially and angularly homogenizing at least a portion of said radiation disposed between said light source and said sample.

2. The illumination subsystem of claim 1, wherein said means for spatially and angularly homogenizing said radiation is a light pipe.

3. The illumination subsystem of claim 2, wherein said light pipe has a polygonal cross section.

4. The illumination subsystem of claim 2, wherein said light pipe includes one or more bends to achieve angular homogenization.

5. The illumination subsystem of claim 1, wherein angular homogenization is achieved, at least in part by passing the radiation through a glass diffuser.

6. The illumination subsystem of claim 2, wherein said light pipe includes a diffusely reflective coating on the interior surface thereof.

7. An illumination subsystem for use in optical analysis of a sample comprising:

a light source generating radiation and a radiation homogenizer disposed between said light source and said sample for spatially and angularly homogenizing at least a portion of said radiation prior to illuminating said sample.

8. The illumination subsystem of claim 7, wherein said radiation homogenizer is a light pipe.

9. The illumination subsystem of claim 8, wherein said light pipe has a polygonal cross section.

10. The illumination subsystem of claim 8, wherein said light pipe includes one or more bends to achieve angular homogenization.

11. The illumination subsystem of claim 7, wherein angular homogenization is achieved, at least in part, by passing the radiation through a glass diffuser.

12. The illumination subsystem of claim 8, wherein said light pipe includes a diffusely reflective coating on the interior surface thereof.

13. An illumination subsystem for use in optical analysis of a sample comprising:

a light source including a filament generating radiation, wherein the radiation exiting the illumination subsystem has a spatial and angular distribution which is repeatable through a one-millimeter vertical translation of the filament resulting in a standard deviation of less than 0.053 in spatial distribution and a standard deviation of less than 0.044 in angular distribution.

14. An illumination subsystem for use in optical analysis of a sample comprising:

a light source including a filament generating radiation, wherein the radiation exiting the illumination system has a spatial and angular distribution which is repeatable through a 90-degree rotational translation of the filament resulting in a standard deviation of less than 0.050 in spatial distribution and a standard deviation of less than 0.066 in angular distribution.

15. An illumination subsystem for use in optical analysis of a sample comprising:

an illumination system with a light source that reduces the inverse multivariate signal-to-noise value to 60 or less when the light source is changed in the illumination subsystem.

16. The illumination subsystem of claim 15, wherein said means for reducing the inverse multivariate signal-to-noise value includes a light pipe.

17. The illumination subsystem of claim 16, wherein said light pipe has a polygonal cross section.

18. The illumination subsystem of claim 16, wherein said light pipe includes one or more bends to achieve angular homogenization.

19. The illumination subsystem of claim 15, wherein the means for reducing the inverse multivariate signal-to-noise value includes a glass diffuser.

20. A light pipe for use in conjunction with spectroscopic analysis, the light pipe comprising:

a proximal end, a distal end, and a length of material therebetween, the light pipe further having a non-circular polygonal cross-sectional area, wherein the light pipe internally reflects radiation introduced through the proximal end of the light pipe, and wherein the radiation emitted from the distal end of the light pipe has been spatially and angularly homogenized by the light pipe.

21. The light pipe of claim 20, wherein the light pipe comprises a material selected from the group consisting of a metal, an amorphous glass, a crystalline, a polymer, and any combinations thereof.

22. The light pipe of claim 20, wherein the length of the light pipe is a straight segment having a diffusely reflective coating on the interior surface thereof.

23. The light pipe of claim 20, wherein the length of the light pipe includes at least one bend.

24. The light pipe of claim 20, wherein the light pipe includes an S-shaped bend.

25. The light pipe of claim 20, wherein the polygonal shape includes polygonal forms having three or more sides.

26. The light pipe of claim 20, wherein the cross-sectional area at any one point along the length of the light pipe may vary in shape with a second cross-sectional area taken at a second point along the length of the light pipe.

~~27. The light pipe of claim 20, wherein the inner diameter of the lumen is textured.~~

28. The light pipe of claim 20, wherein the length of material between the proximal end and the distal end is of solid construction.

29. The light pipe of claim 20, wherein the internal reflectance of radiation is selected from the group of specular reflectance, diffuse reflectance, and a combination thereof.

30. A spectroscopic system for measuring analyte concentration in a sample, the system comprising:

a radiation source emitter, the emitter emitting radiation;

a radiation homogenizer disposed to receive at least a portion of said emitted radiation, wherein the homogenizer angularly and spatially homogenizes at least a portion of said emitted radiation, wherein said homogenized radiation illuminates said sample; and

a sample source, the sample source having an analyte; and

a detector for receiving at least a portion of the radiation subsequent to interacting with said sample.

31. The spectroscopic system of claim 30, wherein the radiation source emitter is a tungsten-halogen lamp.

32. The spectroscopic system of claim 30, wherein the emitted radiation possesses a band of wavelengths within the infrared regions of the electromagnetic spectrum.

33. The spectroscopic system of claim 30, wherein the spectroscopic system includes a means for concentrating the radiation emitted by the radiation source emitter.

34. The spectroscopic system of claim 30, wherein the spectroscopic system includes a means for channeling the emitted radiation to the sample source.

35. The spectroscopic system of claim 34, wherein the channeling means is at least one fiber optic wire.

36. The spectroscopic system of claim 34, wherein the channeling means is at least one mirror.

37. The spectroscopic system of claim 34, wherein the channeling means is at least one optic lens.

38. The spectroscopic system of claim 30, wherein the radiation homogenizer is a light pipe, wherein the light pipe has a proximal end, a distal end, and a length of material therebetween, the light pipe further having a cross-sectional area.

39. The spectroscopic system of claim 38, wherein the light pipe includes a plurality of bends.

40. The spectroscopic system of claim 39, wherein the plurality of bends form an S-shaped bend.

41. The spectroscopic system of claim 38, wherein the cross-sectional area of the light pipe is polygonal in shape.

42. The spectroscopic system of claim 41, wherein the polygonal shape includes all polygonal forms having three to an infinite number of sides.

43. The spectroscopic system of claim 30, wherein the sample is biological tissue.

44. The spectroscopic system of claim 30, wherein the sample is a human appendage, or a portion thereof.

45. The spectroscopic system of claim 30, wherein the analyte measured is glucose.

46. The spectroscopic system of claim 30, wherein the analyte measured is alcohol.

47. The spectroscopic system of claim 30, wherein the spectroscopic system includes at least one bandpass filter.

48. A method for homogenizing radiation for spectroscopic analysis, the method comprising the steps of:

providing a spectroscopic system, wherein the system comprises a radiation source emitter, a radiation homogenizer, a sample having an analyte concentration, and a radiation detector;

emitting ~~radiation~~ by means of the radiation source emitter;

angularly homogenizing the emitted radiation;

spatially homogenizing the emitted radiation;

illuminating the sample source with the homogenized radiation; and

detecting ~~the analyte concentration~~ within the sample source.

49. The method for homogenizing radiation for spectroscopic analysis of claim 48, wherein the radiation homogenizer is a light pipe.

50. An optical measurement system used to measure an analyte or attribute in a biological system, the system comprising:

a spectrometer including a source and a collection system;

a sampling system for performing reflectance measurements on tissue;

a measurement system for measuring multiple wavelengths in the range for 4000 cm^{-1} to 7500 cm^{-1} ;

a prediction process that uses multiple variables obtained from the measurement system; and

an illumination system that does not introduce prediction errors of clinical significance when used in a standard manner.

51. The illumination system of claim 50, wherein the illumination system uses both angular and spatial homogenization of the source output.

52. The system of claim 51, wherein standard operation would include bulb aging and replacement of the bulb.

53. The system of claim 51, wherein the analyte of interest is glucose and a prediction error of clinical significance is 10 mg/dl.